Climate Smart Agriculture (CSA) Guidance Note

Practices, Potential and Barriers in Adoption among Smallholder Farmers + Recommendations for Implementation in Sierra Leone

1. Introduction

The findings in this guidance note were compiled within the scope of assessments commissioned by the EU-funded Boosting Agriculture and Food Security (BAFS) Project to support the Ministry of Agriculture and Forestry (MAF) integrating Climate Smart Agriculture (CSA) in their agricultural extension work at district and community level as well as mainstreaming elements in the Ministry's strategic focus.

The paper covers general consideration about CSA and adoption by farmers as well as a table with remarks about selected CSA elements relevant in Sierra Leone: Current practices, barriers in adoption among farmers, and recommendations for activity and programmatic planning.

2. Background

Uncertain changing climate has contributed greatly to disturbed farming activities of smallholder farmers in Africa including Sierra Leone. Therefore, it is very crucial to explore agricultural practices that can help to adapt and mitigate negative climate factors and contribute to boosting production and productivity. Climate Smart Agriculture (CSA) elements and technologies experience increasing popularity and promotion in many parts of the world and are praised for matching smallholder farmers' realities, their adaptiveness to climate variations, and contribution to environmentally sustainable agriculture and food security.

Defining CSA

The Food and Agriculture Organization (FAO) defines Climate Smart Agriculture (CSA) as an approach that helps a transition to agriculture and food systems that are more productive, more sustainable and more climate-friendly. This is achieved by promoting the adoption of climate-smart practices that have been proven to be effective based on solid evidence, and providing an enabling environment that includes conducive policies, institutions and finance.

CSA is composed of three main pillars:

1. Sustainably increasing agricultural productivity and incomes;
2. Adapting and building resilience to climate change;
3. Reducing and/or removing greenhouse gases emissions, where possible.

While CSA approaches have been actively promoted in projects and programmes in Sierra Leone for more than a decade, the adoption of CSA principles and elements by smallholder famers is still extremely limited. Evidently, the high reliance on NGOs support, limited knowledge, pest and diseases, high labour and maintenance demand among others are challenges and barriers in everyday farming work and life that make farmers reluctant to embrace and practice CSA elements, especially after project incentives end.

Hint Box 1: Group Farm vs. Individual Farm

Very often, farmers seem more motivated to practice new agriculture techniques on their own individual plots rather than in group demonstration plots. This is because there is more motivation to receive the benefits from their own field. In addition, the success is more tied to their own performance and within their own control as compared to a group, where some members may not be motivated to put much effort and succeed.

As a result, one needs to decide case by case when a group farms is suitable to promote a new technology or practice in a project, or if it will be maintained and adopted more successfully on individual farms when individual farmers work with and take care of the new technology or practice.

3. Purpose of the Guidance Note

This guidance note gives insights how farmers are currently practising different CSA elements, what prevents farmers to adopt CSA and implications for promoting CSA elements at project level.

The guidance helps to identify concrete barriers and hints at challenges that prevent famers from adopting CSA elements and practices. Very often such aspects are not adequately considered in scientific and policy guidance for implementing CSA, because they are linked to farmer behaviours, motivation and priorities rather than technical agronomic aspects of the environment they are implemented in.

It seeks to draw attention to aspects of farming which are not purely agronomic, but which farmers are faced with in their everyday agricultural work.

Ministry of Agriculture and Forestry (MAF)

Funded by the European Union

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Duration: 2016-2022

Hint Box 2: Workload and Labour Availability

High labour investment is a common element of smallholder agricultural work and could traditionally be met by family or rotational group labour – which especially young men would undertake, e.g. for heavy earth works. While rotational labour can still be a good solution, its effective utilization depends on the type of work to be done and the priorities, circumstances and challenges each group member is facing (e.g. work that is very timebound may not work in rotational labour as the farms that are served last can lose out).

Nowadays, rural-urban migration of youth in search of non-farm income opportunities and loss of interest in agriculture interrupt this important livelihood resource. Easy to access labour force has become a scarce asset and cannot be easily compensated with an on-farm alternative.

Although youth migration and lack of interest in farming is not a new finding and commonly known problem, it needs to be put into the right perspective when designing and implementing projects that target smallholder farmers: labour is not readily available and farmers need to prioritize which farm investment to allocate work/labour or financial resource to. Here, some agriculture methods and CSA elements might not be a priority for farmers and they would put priority to something where fast benefits and profits will come out of.

The guidance is to inform two major target audiences:

- Policy makers, donors and project planners when designing strategies and overall plans relating to agriculture and climate change to be aware of the actual ordinary challenges and barriers that farmers face. This will prevent trying to implement plans and CSA activities which assume idealized farmer behaviour.

- Project managers, subject matter specialists and field extension staff (Ministry, NGO) to better understand the challenges and barriers when advising farmers in their real life on agricultural topics, so thus helping to find workable solutions to circumvent specific impediments.

In addition, there are two recurring issues when talking to farmers, extension staff and experts within the scope of this assessment: 1) working with groups vs individuals 2) availability of farm labour (due to migration). Both issues require thorough consideration need to be critically and openly discussed in planning interventions (*Hint Box 1, Hint Box 2*)

4. About CSA and Adoption of Agricultural Technologies

CSA can be applied to many elements in agricultural processes. CSA is not a technique, a new production system or a one-size-fits all set of practices, but rather an approach that involves different elements that are embedded in specific natural and social contexts and tailored to meet local needs. CSA elements do not attempt to provide a completed solution to farmers. Rather CSA serves as putting farmer local knowledge into perspective to identify locally appropriate solutions and integrating the need for adaptation and the possibility of mitigation in agricultural growth strategies to support food security amidst climate change.

Generally, to implement such an agricultural approach, there are certain requirements and specific challenges to consider. Some apply specifically to men and some specifically to women farmers. Given the fact that women and men have different priorities, needs, motivation and challenges in agricultural activities any programme promoting the adoption of CSA technologies needs to genuinely apply a gender-responsive approach.

Noting that the listed CSA elements are intrinsic part of farmers lives and food system, one must take cognizance of the specific socio-economic set-up and livelihood strategies individual farming households have – where farmers place their priorities to improve their living. Adoption of new technologies in agriculture is a complex process and to a large extend linked to people's behaviours and attitudes; needs, preferences, priorities - not only depending on technical (agronomic) aspects of a new practice.

For CSA that would mean that one must assess where the agronomic suitability of a technique also matches farmer behaviour and priorities on the ground. Even if a CSA element or technology is shown to deliver significant benefits in terms of agricultural productivity, adaptation and mitigation, farming households may still not apply it. It is important to understand the local drivers and barriers to adoption.

5. Notes on the Guidance Note

The information that this guidance note is based on - especially the next table - were gathered during a joint BAFS-MAF assessment (December 2020 / January 2021) using focus group discussions and expert interviews with farmers, staff of MAF at central and district level, field extension agents and individual professional specialists. Three districts were visited (Kambia, Kenema, Koinadugu) for field interviews and visitation of CSA demonstration plots.

The guidance note does not claim to be complete and the findings within it are indicative. The table with different aspects of CSA and barriers to adoption aims to give some insights and food for thought to others to think more about when and why it can become difficult for farmers to adopt new practices and technologies and what programmes or projects must consider when implementing CSA approaches.

To have a more comprehensive understanding of CSA specific aspects and the potential adoption by famers, one must delve into this subject in greater depth. This guidance is helpful laying the groundwork and identifying interesting and crucial aspects and considerations when engaging farmers on CSA or designing strategies and programmes.

Selected CSA elements, prevalence in Sierra Leone, barriers for adoption and strategies to overcome them.

CSA element	Description of the CSA element	Status and challenges in Sierra Leone	Barriers for adoption at farmer level	Ways to overcome constraints at farmer or programme level
Agricultural subsidies	Targeted subsidies supporting efficient fertiliser use, reward conservation efforts, protect land from further clearing, and restore agricultural land no longer in use.	No practice of agricultural subsidies (reported by farmers)		Programme level: - MAF/development partners to trial and establish subsides initiatives related to farmers adopting CSA (e.g. micro dosing in fertiliser use, agroforestry/afforestation)
Agroforestry (including multistorey cropping and woodlots)	The integration of trees along with annual or perennial crops or livestock can create a more diverse, productive, and ecologically sound land use and environment. - Diversity gives more habitats for many species of plants, animals and other organisms. - Improves air quality: trees work as windbreaker and help to reduce soil erosion; this reduces dust and other particles in the air. - Soil fertility: decaying biomass protects soil surface through litter and more carbon is stored in the soil. - Water retention: trees slow the flow of water due to their above and below ground biomass.	Farmers integrate fruit trees including avocado, orange, lime, guava, soursop, cashew, cocoa, coffee, bananas, plantains, papaya, coconuts, oil palms and other timber trees. The inclusion of trees into farms has a commercial purpose (cash crops). Planting trees for agro-ecological reasons is less common.	- Planting of trees involves high Initial and maintenance costs. - Farmers have to wait for several years before gaining a benefit from investment in trees. - Agro-ecological services of trees to the farm ecosystem are not easily and quickly visible to farmers. - If the land is not owned by the farmer, planting of trees on crop farms require consent from the landowners. At the same time, long-term security and access to that land and the benefits of the trees is not guaranteed. - Wildfire damage to both natural forests and plantations, particularly in the drier northern region.	Programme level: - Support engagement on favourable land access to farmers (e.g. mechanisms that allow individual agreements) that will allow farmers to secure long term utilization and access to a land so that they are more willing to plant trees.
Application of crop residues, composts to the soil and mulching	Increasing soil organic matter - either by incorporation crop residues/compost or as surface mulch - helps conserving nutrients and energy embodied in the residues. Soil organic matter also supports soil fertility and water filtration, ecosystem services that provide food and water security.	This practice is mostly adopted on vegetable cultivation during upland and lowland farming. However, the adoption is at very low scale.	- Non-availability of residues after burning bush/farmland. - Farmers are afraid of pest and rodent outbreaks in the farms, as they can be attracted by crop residues. - Perception of high labour and considerable time requirement.	Farmer level: - Farmers demand stronger regulation and control of burning of the bush, which destroys their farms. Programme level: - Determined and steady community engagement with stakeholders on by-laws against uncontrolled burning is essential but also depends on the community leadership: their willingness, un-biasedness and influence to enforce by-laws. - MAF needs to engage farmers over a longer time to convince them of the benefits of conservation agriculture practices. - Still, the intensity and quality of engagement depends largely to the motivation and capacities of field extension

				agents. Very often low pay and lack of mobility prevent extension staff to do proper advisory work.
Conservation tillage / Conservation Agriculture (CA)	Minimal soil disturbance, permanent soil cover (and crop rotations) help preventing degradative processes and restores and improves soil productivity.	Only one element of conservation agriculture is adopted in upland farming, which is minimum tillage. This is because the farmers are using hand tools to till the land after clearing. Elements like slash and zero burning are not adopted. Farmers prefer to slash and burn as a common practice, mostly during upland farming. Although there is limited slash and burning in IVS farming.	- High labour demand during initial years, especially with weed control, is one of the main barriers to adopt conservation agriculture practices. - Prevalence of uncontrolled burning (slash and burn) to minimise labour and time - especially in the north - has prevented farmers to adopt the CA. - In addition, cattle farmers burn bushland and eventually farms uncontrolled to induce growth/regeneration to feed plants for their animals.	Farmer Level: - Farmers need to employ ways to meet the high initial labour demand at the beginning of the farm setup under "slash and zero burning", e.g. rotational group labour. - Farmers demand stronger regulation and control of burning of the bush, which destroys their farms. Programme level: - Determined and steady community engagement with stakeholders on by-laws against uncontrolled burning is essential but also depends on the community leadership: their willingness, un-biasedness and influence to enforce by-laws. - MAF needs to engage farmers over a longer time to convince them of the benefits of CA practices. - Still, the intensity and quality of engagement depends largely to the motivation and capacities of field extension agents. Very often low pay and lack of mobility prevent extension staff to do proper advisory work.
Crop rotation	Crop rotation is based on growing a series of different types of crops in the same area in sequential seasons (e.g., to plant leguminous crops after the cereal crops) and then leave the land undisturbed for at least one season. Benefits: - Good for soil fertility - Reduces pest infestations - Reduces soil erosion	Farmers are practising crop rotation in the IVS: during the raining season they cultivate rice and during the dry season farmers cultivate different crops, especially vegetables and green leaves. While crop rotation is not too common in upland farming, it is practiced to a small extend: Some farmers cultivate rice, followed by groundnuts, cassava, pepper or maize. However, the number of different types of crops is much smaller compared to IVS farms where crop rotation is practiced to a larger extend with different types of crops. The practice of leaving farmland undisturbed for at least one season is not common.	- Farmers do not adapt more crop rotation on upland farms due to the non-availability of water that is required to farm outside the rainy season.	Programme level: (*see 'Small scale irrigation and drainage systems'*)

Crop storage and processing	Improved storage, processing and preservation reduce post-harvest losses and thus enhance food availability at household level. As a result, it reduces pressure on agricultural limited resources (soil, nutrients, water etc).	Farmers mostly store their crops in sacks/baskets (plastered with clay or cow dungs), and grain bags, sometime underground for tubers like cassava, potatoes, carrots and yams.	- Risk of pest and rodents (rats) doing damage to stored crops. - Some farmers do not store crops. They consume immediately after harvest.	Farmer level: - Apply dried pepper and salt to prevent insects from attacking stored crops, especially grains. - Cats to chase rats / rat traps. - Ensuring proper sanitation around the storage area.
Efficient fertiliser use (precision micro dosing)	Micro dosing involves the application of small, affordable quantities of fertiliser onto the seed at planting time, or a few weeks after emergence. This enhances fertiliser use efficiency, instead of spreading fertiliser over the field, and improves productivity.	This practice is not too common. Broadcasting of fertiliser is mostly common among farmers. Still, farmers are adopting a kind of "micro dosing" because they do not have enough fertiliser (e.g. from the MAF, or due to limited financial resources to buy from the market) to apply it on a vast area.	- Farmers' perception of high labour requirement and that it takes too much of their time. - Limited understanding about the required dosage to apply and which fertiliser is suitable for which crop. - Farmers' fear of excess application of the fertiliser which can lead to damage of the crops.	Programme level: - Improve extension service (engagement with farmers) to provide knowledge to farmers about the proper application and dosage requirements of fertilisers to undertake precision micro dosing. - Build capacities of extension staff on efficient fertiliser use and how to do micro-dosing.
Integrated crop and livestock systems	Integration of crop, pasture, and livestock is mutually beneficial to each other: Crop residues can be used as animal feed, while animal manure can be utilised to enhance soil tilth, fertility, and carbon sequestration that can enhance agricultural productivity. The combined system enhances soil biological activity and nutrient recycling, increases crop yields, intensifies land use, prevents soil erosion.	Farmers usually allow cattle into the IVS after harvest during the dry season; before engaging in greens and vegetables cultivation. The cattle are left on a free range to graze on IVS (and also upland) before the planting season. The cattle are then withdrawn into the paddocks. The release of cattle and other animals to the IVS usually happens after consent has been sought from the crop farmers or landowners. (Integrated crops-livestock systems like fish or ducks with rice in IVS are not common)	Challenge to integration of crop and livestock: - Sometimes, livestock farmers release the cattle to the fields before harvest or they delay withdrawing the cattle from the fields when time for cultivation comes. This is to the detriment of crop farmers.	Farmer level: - Depending on the income/labour available to farmers, proper fencing around cultivated areas can prevent cattle to destroy crops. Programme level: - Establish determined and steady community engagement with stakeholders to enforce by-laws and prevent early release of cattle to fields. - Explore and promote more affordable/innovate ways of fencing.
Integrated Pest Management (IPM)	IPM is an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimise the use of pesticides. IPM emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. IPM is not a "packaged technology" that is "adopted" by farmers. IPM is a process of decision-making and farming which is gradually improved with greater ecological knowledge and observation skill.	IPM practices include hand picking, sprinkling of wood ash on the crops as a physical poison usually causing abrasion and exposing pest to death, proper pruning of tree crops, construct traps around the farms. However, these methods are only practiced to a limited degree.	- Hand picking practice is very time consuming. Farmers have to spend a lot of time on it which would have been used for another income generating activity. - It requires additional labour amid other farm labour requirements. - The labour is mostly solicited from their children and other close family members. Children are now going to school, youths tend to migrate to urban areas for non-farm income activities. The labour is now mostly done by the aged people in the communities.	Programme level: - More exchange visits between farmers to share good workable IPM practices (e.g. less time consuming, clear visible benefit)

Intercropping for crop diversification	Intercropping involves cultivating two or more crops in a field simultaneously which can have beneficial effects on soil fertility and nutrient cycling, allowing low input agricultural practices.	In the IVS, farmers practice intercropping of vegetables with greens. In the upland farmers intercrop rice with sorghum, corn, egg plan, among other crops. Intercropping is also practised with permanent crops like cashew, mango, oil palm, cocoa and coffee, e.g. short term crops including vegetables and rice.	- Intercropping requires a considerable amount of labour at once – especially during land preparation and harvesting periods - because (at least) two different crops must be worked on at the same time. - If the required labour force is not available farmers will tend to only work on the crops which yields more evident/visible benefit for the farmer. - Intercrops attract pests and diseases that can do damage to permanent crops.	Farmer level: - Follow appropriate spacing between intercrop and the permanent crop to prevent spread of pest and diseases. - Plant intercrops (annual/seasonal) which do not attract pest and diseases that can affect and damage the permanent crop. Programme level: - Identify and promote intercrops which do not attract pests and diseases that can damage the permanent crops.
Manure management	Manure as a fertilizer can be an asset, promoting sustainable agriculture, and increasing crop production. Practices include roofing animal housing, having a water-proof floor or covering manure during storage.	Manure management as a CSA element is practiced in a very basic way. Farmers utilize manure, including poultry dung, cow dung, husk rice, rice brand, and compost. They usually burn animal dung and use the ashes to broadcast as fertilizer on their farms. Still, animal dung as manure is not effectively managed. Farmers are not covering manure during storage / are not using a water-proof floor. This contributes to a large nutrient loss during storage.	- Limited knowledge about proper manure management and different types of manure production and utilization.	Programme level: - Extension staff: to advise farmers and increase their understanding about appropriate manure management. - Management: Build capacities of extension staff to advise farmers on cheap and practicable manure management.
Planting of trees **(e.g. for fuel-efficient cooking stoves)**	Improved cooking stoves need far less fuelwood for energy and thus help reducing immediate deforestation around communities.	There is awareness about planting trees for fuel wood / setting up woodlots, but farmers are not practising it.	- Farmers have enough access to tree branches and timber for cooking.	Programme level: - MAF and development partners need to engage more with farmers and other community stakeholders and raise awareness about the importance of this practice.
Reforestation/ afforestation **(including fast growing trees)**	Deforestation is one of the main contributors to climate change and biodiversity loss. It destroys local ecosystems and impacting agricultural potential and thus adversely impacts livelihoods. By conserving and sustainably managing forests and planting trees, smallholders contribute to reducing deforestation and forest degradation.	Re/Afforestation is mostly done with commercial trees - cocoa, coffee, timber trees, oil palm, cashew - and to a lesser extend with mango, avocado or other fruit trees. Farmers are planting these trees mainly for financial reason, not to support ecosystem services. Still, in the process they involuntary support the covering of the soil and other functions. (However, planting commercial trees in plantation-like settings has limited value to enhancing biodiversity and are only likely to support biodiversity in already degraded areas.)	- Farmers must wait for several years before harvesting fruits or wood and thus getting a benefit from trees. - If the land is not owned by the farmer, planting of trees requires consent from the landowner. - No long-term assurance of being able to get the benefits from trees after several years. - Wildfire damage to both natural forests and plantations particularly in the drier northern region is a common challenge.	Programme level: - Support engagement on favourable land access laws to farmers (e.g. mechanisms that allow individual agreements) that will allow farmers to secure long terms access to a land so that they are more willing to plant trees.

Seed banks / seed storage	Seed storage and seed banks allow farmers to cultivate larger numbers of different local varieties - which have been able to adapt to different environmental conditions and changes (e.g., shortages of water, limited soil nutrients and so on) – rather than relying on commercial varieties that are not suited to the particular local environment.	Majority of farmers dry and store their seeds either at the house (under the roof or bed), or outside the house (veranda or at the farm under a "banda" hut). Farmers also store their seeds on top of pallets in community grain stores which are built by NGOs or the Government. Farmers use nylon bags ('Indian bags') and jute bags to keep their seeds; more so for rice, cocoa and coffee seeds. For greens and vegetables, seeds are kept in bottles and jerry cans. Some farmers rap their seeds in clothes.	- Pest and diseases attack to the seeds are a common challenge and disturbance to farmers. Also, the seeds lose their viability which discourages farmers to bank/store seeds. - Farmers are not storing seeds because of hunger. - Farmers that work on vegetables, greens and rice production are not waiting for the crops to mature properly; they harvest their crops earlier for consumption and sell surplus including seeds that could be banked for next planting season to buy other family needs.	Farmer level: - Ensure proper sanitation around the seed store, to reduce pests and diseases. - Farmers must patiently wait to ensure seeds dry properly before storage to reduce excess moisture content in seeds and avoid diseases. Programme Level: - Assess viable storage and loaning schemes (MAF offers seasonal seed supplies on loan, but most time, farmers are not able to repay the seed loan). - Promote innovative, practicable and cost-effective storing methods. - Encourage testing of moisture content of seeds before storing.
Small scale irrigation and drainage systems	Due to changes in climate and rainfall patterns the traditional methods of rain-fed farming are unable to guarantee sufficient income and food. Simple irrigation and drainage systems that can be produced locally can help mitigate effects of extreme rainfall patterns (not enough or too much rain) and help expand agricultural production.	The use of buckets and to get water from a shallow borehole and use of watering cans to irrigate crops is the major irrigation practice common among farmers. It is mostly practised in the IVS with vegetables and greens during the dry season. In addition, proper IVS drainage/water control structures were support by the government and NGO, which regulate water flow during the rainy season.	- High time and labour requirement to build water control structures. - Farmers find it difficult to purchase basic irrigation systems because of the financial costs involved. - (Farmers are often heavily relying on the MAF and NGOs to develop their IVS)	Farmer level: - The application of rotational group labour among farmers is necessary to the development of water control structures in the IVS. Programme level: - Promotion of affordable and easy-to-maintain irrigation systems. - Promotion of practicable credit facility to be able to buy irrigation systems. - Combine irrigation with cash-for-work schemes or cash-transfers.